

Attracting Students To Magnetism and Electricity
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Overview
Rationale
Objectives
Strategies
Classroom Activities
Annotated Bibliography/Resources
Appendices
Standards

Overview: The Pittsburgh Public Schools have adopted the FOSS (Full Option Science System) in the elementary schools as the Science Curriculum. Part of the fourth grade curriculum is the study of magnetism and electricity. The FOSS curriculum provides a directed program that allows students to perform investigations using the equipment that is provided in the FOSS kit on Magnetism and Electricity. This curriculum incorporates the scientific method. Students are also asked to report their findings using a variety of forms supplied by the FOSS unit on Magnetism and Electricity. Mathematics and writing skills are also necessary for students to complete the assignments in the unit.

We use a supplementary calendar that is sent from the Science Department to provide added activities for students to use during their time at home. A different calendar is available each month and usually relates to the curriculum to be taught during that time period. I would like to use this idea to give students information and actual investigations that can be done to supplement the Magnetism and Electricity curriculum. This curriculum unit will tell students where to find information that will help them to increase their knowledge of the subject and give them actual experiments that can be done at home or at time provided during lunch recess or at other free times here at Roosevelt Elementary School.

The investigations will coincide with the FOSS Magnetism and Electricity unit and will be used by students at home as well as at school. These experiments will use materials that are available at home or here in the science room and will not cause students to incur extra expense.

Rationale: Fourth grade students are very interested in using magnets and working with batteries to make circuits and to discover how electricity works. They could carry their studies further if they had investigations that could be done outside of the assigned curriculum. These investigations would be related to magnetism and electricity. They would use materials that the student may have in their home or could borrow from the Science Room. These investigations are ones which should also be simple so that students could do them on their own without assistance and they should be simple enough that parents and students can work together at home without confusion. This unit will use the FOSS curriculum which is adopted for the Pittsburgh Public School students related to magnetism and electricity. The science standards for elementary students will be followed so that the experiments that supplement this unit will reinforce those standards as well as review the material taught in science class.

Once students have completed an investigation during class, they will be able to refer to this curriculum and work independently at home or during designated times here in the school. Each of the investigations in this unit is intended to support some aspect of the work that the students have already completed in the classroom with the teacher during class.

As students complete the investigations, they will keep a record of their work in their journals. I will review their journals with them and ask them to report their findings. They can make reports during Science classes.

The unit will also direct students to the internet where they can find materials to further support their classroom investigations on magnetism and electricity. Students will use the science class time in the computer lab to study these sites and print investigations which they can then use at home to reinforce what they have already learned in the classroom.

This curriculum unit will be available to the fourth grade students during the use of the FOSS unit on Magnetism and Electricity. It will also be available at all times during the school year after the study of magnetism and electricity. Fifth graders will also be permitted to use the experiments outlined in the unit. This will reinforce what they learned in the fourth grade on magnetism and electricity.

Objectives: The students will follow the Pittsburgh School District Science standards and will use the FOSS curriculum on Magnetism and Electricity in the fourth grade program to reinforce their learning in the science classroom.

Standard #6 will be the main focus of this unit. The standard is... all students develop and apply skills of observation, data collection, analysis, pattern recognition, prediction and scientific reasoning in designing and conducting experiments and solving technological problems.

The children in grade four will use the computer lab to research the sites made available in this unit. Grade five students will also use the computer lab for a review of the material learned in their fourth grade FOSS curriculum. The fifth graders will also have the magnetism and electricity curriculum available for review in the science room as well as well as having information available which can help them to complete these investigations at home.

Strategies: The Roosevelt Elementary Students in grade four will use the curriculum unit as a supplement to the materials in the FOSS Magnetism and Electricity unit. The students will attend Science class from three to five periods per week. One of their classes will take place in the computer lab.

When the students are following the FOSS Magnetism and Electricity unit, the supplementary curriculum unit will be available for use as reinforcement of the investigations done in the classroom. The computer room time will give students the opportunity to reach the sites recommended in the unit.

Students will be encouraged to come to the science room or computer lab during recess during lunch to participate in the investigations that are recommended in the magnetism and electricity unit. There will be a special emphasis for the fourth and fifth graders to complete the investigations during these times. Third graders will be welcome to come at a free time during lunch to try the magnetism and electricity experiments and will borrow materials that will help them try some of the investigations at home.

Classroom Activities: Investigation #1 How Magnets Interact

The investigation selected relates to the investigation #1 on page 6 in the FOSS Science story book on Magnetism and Electricity. The source for teachers as well as students is <http://www.nyu.edu/projects/mstep/lessons/magnets.html>

At the conclusion of these activities, students will be able to:

- understand that some materials are magnetic and some are not
- identify natural magnets and manufactured magnets
- test a sample to determine if it is magnetic
- understand that magnets contain two opposite poles
- understand the concept of the magnetic forces of attraction and repulsion
- understand magnetic fields
- make a temporary magnet
- report findings
- infer the magnetic properties of a material.

Activity 1 – Magnetic observations

For each group of two participants, provide the magnets and testing materials.

Procedure:

- Distribute one magnet to each student. Brainstorm for descriptive words about magnets. Make a list of the words.
- Demonstrate how a magnetic material is attracted (“Sticks to”) to the magnet. Ask for an explanation of the observed phenomenon.

- Distribute the testing materials to each group. Before any testing occurs, elicit predictions as to which objects will be attracted to the magnet. Record your predictions.

- Test objects and record observations.
- Review findings. Develop the rule for determining if an object is magnetic.
- Direct participants to identify objects around the room to test. Ask them to predict, based on the rule, whether they are magnetic. Record predictions.
- Test the objects and record observations.
- Demonstrate the ability of the lodestone to attract. Explain. Discuss natural and manufactured magnets.
- Predict what will happen with sand.
- Test the sand.
- Report results.

Activity #2 – Attractions Use various magnets and magnetic materials to quantify the attraction force.

Procedure:

- Distribute magnets, a box of steel paper clips and steel washers.
- Predict how many paper clips a particular magnet will attract.
- Record observations
- Record, compile and graph data to determine which type of magnet was able to attract the greatest number of paper clips.
- Explore moving the magnetic objects along the tabletop without touching. Explore by placing magnets a distance from the objects and under the tabletop.
- Participants draw inferences from data through brainstorming.

Activity #3 – How do magnets interact?

Procedure:

- Distribute two bar magnets
- Predict what will happen when the two magnets are placed near each other.
- Place magnets near each other using three different orientations. Observe how the magnets interact.
- Develop a rule for the observed phenomenon using the terms force, attract and repel.

- Distribute nails and paper clips. Make a temporary magnet with these objects.
- Experiment until they can pick up the paper clips with the nail after rubbing one pole of the magnet along the length of the nail.

Activity #4 – Magnetic fields

Procedure:

- Distribute paper
- Distribute bar magnets. Place the magnets one to two inches apart so that they attract or repel.
- Predict what will happen when iron filings are poured on the paper over the area where the magnets reside.
- Pour iron filings on the paper.
- Report the results.

Experiments with Static Electricity Investigation #1 Sticking a Balloon to Things

<http://www.school-for-champions.com/science/experiments/expstatic1.htm>

Questions to answer through these experiments:

- Will the balloon stick to anything?
- What materials work the best?
- How long will the balloon stick to the wall?
- What would happen if you rubbed two balloons and tried to stick them together?

Materials:

- Balloons

- Wool, clothes, and other things to rub against the balloon
- String
- Materials to stick against (usually parts of the room)
- Clock or stopwatch

Static electricity experiments work the best on dry days. Rain or dampness may cause investigations not to work well.

Experiment with sticking to different materials

1. Rub a balloon some wool or your shirt.
2. Then try to stick the balloon to different materials-like the wall, a door, the chalkboard.
3. Make a list of the materials and how well the balloon sticks.
4. Draw some conclusions about the best and worst types of materials to stick to.

Experiment on materials to rub on

1. Rub a balloon some wool or your shirt.
2. Then try to stick the balloon to different materials-like the wall, a door, the chalkboard.
3. Make a list of the materials and how well the balloon sticks.
4. Draw some conclusions about the best and worst types of materials to stick to.

Experiment on materials to rub on

1. Rub a balloon with different materials to see which works best for sticking it to the wall.
2. Make a list of materials and how well they work for creating static electricity.
3. Draw some conclusions and try to explain the reasons.

Experiment with length of time

1. Use a clock to measure how long the balloon will stick to an object.

2. Try this several days apart to see the effect that weather or humidity has on the length.
3. Make a chart listing the time and the weather.
4. Draw some conclusions.

Experiment with two balloons

1. Tie two balloons to pieces of string.
2. Rub each balloon with the same material to charge it
3. Hold the string and let the balloons get close
4. Do they attract or repel? Why? Explain reasons for what happens.

The following experiments can be found on the website:

<http://www.exploratorium.edu/snacks/snackintro.html>

Each investigation contains materials, assembly instructions and time, to do and notice and the time needed, what's going on and etc.

1. Bronx Cheer Bulb

Some light sources may appear to wiggle and flash when you give them the raspberry, but the only thing wiggling is you.

Some light sources flash on and off many times a second. When you give them the "Bronx cheer," you can see their hidden flickering.

2. Charge and Carry

Store up an electric charge, then make sparks.

Are you tired of electrostatic experiments that just won't work?

This experiment will produce a spark that you can feel, see, and

Hear. You rub a Styrofoam plate with wool to give it a large electric charge. Then you use the charged Styrofoam to charge an aluminum pie pan. The entire apparatus for charging the aluminum plate is called an electrophorus, which is Greek for charge carrier. An even larger charge can be stored up in a device called a Leyden jar, made from a plastic film can.

3. Circles of Magnetism I

Compass needles are little magnets that are free to rotate. Compasses allow us to observe the direction of a magnetic field.

Normally, they respond to the earth's magnetic field, orienting themselves parallel to magnetic field lines. If we create a magnetic field that is stronger than the field of the earth—for example, by using electric currents—a compass needle will orient itself parallel to the new field.

4. Circles of Magnetism IV

Two parallel, current-carrying wires exert forces on each other. When an electric current flows through a wire, a magnetic field is created around the wire. If you place two current-carrying wires near each other, the magnetic field around each wire exerts a force on the current flowing in the other wire. These forces can push two current-carrying wires apart, or pull them together.

5. Eddy Currents

A magnet falls more slowly through a metallic tube than it does through a nonmetallic tube.

When a magnet is dropped down a metallic tube, the changing magnetic field created by the falling magnet pushes electrons in the metal tube around in circular, eddy-like currents. These eddy currents have their own magnetic fields that oppose the fall of the magnet. The magnet falls dramatically slower than it does in ordinary free fall in a nonmetallic tube.

6. Electrical Fleas

Start your own electric flea circus!

You're probably familiar with some of the effects of static electricity: Static electricity makes the sparks when you comb your hair on a cold day, and it makes balloons stick to the wall at a birthday party.

7. Electroscope

What's your (electrical) sign?

A commonly available brand of plastic tape can gain or lose negatively charged electrons when you stick it to a surface and rip it off. By suspending pieces of tape from a straw, you can build an electroscope, a device that detects electrical charge. A plastic comb will help you to determine whether the pieces of tape are positively or negatively charged.

8. Hand battery

Your skin and two different metals create a battery.

When you place your hands on metal plates, you and the plates form a battery.

9. Magnetic Lines of Force

Iron filings will trace out the lines of a magnetic field in three dimensions.

Iron filings will line up parallel to a magnetic field, making the pattern of the field visible. This is a simple snack to build, and because the filings are trapped in a bottle, they don't make mess.

10. Magnetic Shielding

Magnetic lines stop here.

11. Magnetic Suction

This experiment shows how your doorbell works.

A coil of wire with current flowing through it forms an electromagnet that acts very much like a bar magnet. The coil will magnetize an iron nail and attract it in a remarkably vigorous way.

12. Short Circuit

What happens when you blow a fuse?

Current flowing through a wire heats the wire. The length of a wire affects its resistance, which determines how much current flows in the wire and how hot the wire gets.

13. Strange Attractor

The attraction and repulsion of magnets produces entrancing, unpredictable motion.

Patterns of order can be found in apparent disordered systems.

This pendulum, a magnet swinging over a small number of fixed magnets is a very simple system that shows chaotic motion for some starting positions of the pendulum. The search for order in the chaos can be very engrossing.

14. Stripped Down Motor

As motors go, this is about as simple as it gets.

A coil of wire becomes an electromagnet when a coil of wire passes through it. The electromagnet interacts with a permanent magnet, causing the coil to spin. You have created an electric motor.

15. Curie Point

When a piece of iron gets too hot, it is no longer attracted to a magnet.

A piece of iron will ordinarily be attracted to a magnet. But when you heat the iron to a high enough temperature, (called the Curie point), it loses its ability to be magnetized. Heat energy scrambles the iron atoms

Appendix-Content Standards:

Science & Technology Standards:

1. All students explain how scientific principles of chemical, physical and biological phenomena have developed and relate them to the real-world situations.
2. All students demonstrate knowledge of basic concepts and principles of physical, chemical, and biological and earth sciences.
3. All students use and master materials, tools and processes of major technologies which are applied in economic and civic life.
4. All students explain the relationships among science, technology and society.
5. All students construct and evaluate scientific and technological systems using models to explain or predict results.
6. All students develop and apply skills of observation, data collection, analysis, pattern recognition, prediction and scientific reasoning in designing and conducting experiments and solving technological problems.
7. All students evaluate advantages, disadvantages and ethical implications associated with the impact of science and technology on current and future life.
8. All students evaluate the impact on current and future life of the development and use of varied energy forms, natural and synthetic

materials, and production and processing of food and other agricultural products.

9. All students demonstrate basic computer literacy, including word processing, software applications, and the ability to access the global information infrastructure, using current technology.

Appendix: Content Standards

Environment and Ecology Standards

1. All students understand and describe the components of ecological systems and their functions.
3. All students think critically and generate potential solutions to environmental issues.
4. All students evaluate the implications of finite natural resources and the need for conservation, sustainable agricultural development
5. All students demonstrate an understanding of the local, national and international implications of environmental and ecological issues.

Reading, Writing, Speaking and Listening Standards:

1. All students use effective research and information management skills, including locating primary and secondary sources of information with traditional and emerging library technologies.
3. All students respond orally and in writing to information and ideas gained by reading narrative and informational texts and use the information and ideas to make decisions and solve problems.

- and
4. All students write for a variety of purposes, including to narrate inform persuade, in all subject areas.
- giving
6. All students exchange information orally, including understanding and spoken instructions, asking and answering questions appropriately, and promoting effective group communications.
- area of
7. All students compose and make oral presentations for each academic study that are designed to persuade, inform or describe.

Bibliography for Teachers

Websites

<http://my.execpc.com/~rroadley/magtypes.htm>

(What types of magnets are there?)

http://www.exploratorium.edu/snacks/bronx_cheer_bulb.html

(This site tells about light sources.)

http://www.exploratorium.edu/snacks/charge_carry.html

that you
can feel, see, and hear.)

http://www.exploratorium.edu/snacks/circles_magnetism_I.html

this
website.)
(You can learn to make a magnetic field that's stronger than the earth's at

http://www.exploratorium.edu/snacks/circles_magnetism_IV.html

(Two parallel, current-carrying wires exert forces on each other.)

http://www.exploratorium.edu/snacks/eddy_currents.html

(This shows how a magnet falls more slowly through a metallic tube than it does through a nonmetallic tube.)

http://www.exploratorium.edu/snacks/electrical_fleas.html

(This website tells you how to start you own electrical flea circus.)

<http://www.exploratorium.edu/snacks/electroscope.html>

(Here you can learn about positively and negatively charged particles.)

<http://www.exploratorium.edu/snacks/iconmagnetism.html>

(This gives an overview of The Exploratorium Science Snacks.)

http://www.exploratorium.edu/snacks/hand_battery.html

(This website shows how to use your skin and two different metals to create a battery.)

http://www.exploratorium.edu/snacks/magnetic_lines.html

(Here we learn how iron filings trace out the lines of a magnetic field in three dimensions.)

<http://www.exploratorium.edu/snacks/magshield/index.html>

(This shows how to stop magnetic lines.)

http://www.exploratorium.edu/snacks/magnetic_suction.html

(This investigation shows how your doorbell works.)

http://www.exploratorium.edu/snacks/motor_effect.html

(A magnet exerts a force on current-carrying wire.)

http://www.exploratorium.edu/snacks/short_circuit.html

(What happens when you blow a fuse?)

<http://www.exploratorium.edu/snacks/snackintro.html>

(Exploratorium Science Snacks are miniature versions of some of the most popular Exhibits at the Exploratorium Museum of San Francisco, California.)

http://www.exploratorium.edu/snacks/strange_attractor.html

(This investigation shows the attraction and repulsion of magnets producing entrancing, unpredictable motion.)

http://www.exploratorium.edu/snacks/stripped_down_motor.html

(As motors go, this is about as simple as it gets.)

<http://www.nyu.edu/projects/mstep/lessons/magnets.html>

(This website explores magnets and magnetism.)

<http://www.pausd.palo-alto.ca.us/k6science/electric/electric.html>

(Learn about electricity.)

<http://www.school-for-champions.com/experiments/expstatic1.htm>

(Experiments involve static electricity.)

<http://www.sciencemadesimple.com/static.html>

(This website gives information and investigations about Static Electricity.)

Full Option Science system, FOSS, revised 2000. This is the curriculum adopted by the Pittsburgh Public Schools. Developed at the Lawrence Hall of Science, University of California at Berkeley, Published and Distributed by Delta Education, Inc., 2000.

FOSS Module:
Grade 4 Module, Magnetism and Electricity

Full Option Science System, Teacher Preparation Video
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Pittsburgh Public Schools Science Education Page,
<http://science.pghboe.net/Elementary>

